

[JP,10-052761,A(1998)]

[Japanese \(PDF\)](#)[File Wrapper Information](#)

Drawing selection

[Representative draw](#)

**FULL CONTENTS CLAIM + DETAILED DESCRIPTION TECHNICAL  
FIELD PRIOR ART EFFECT OF THE INVENTION TECHNICAL  
PROBLEM MEANS OPERATION DESCRIPTION OF DRAWINGS  
DRAWINGS**

[Translation done.]

**Disclaimer:**

This English translation is produced by machine translation and may contain errors. The JPO, the INPI, and those who drafted this document in the original language are not responsible for the result of the translation.

ID=000002

**Notes:**

1. Untranslatable words are replaced with asterisks (\* \* \* \*).
2. Texts in the figures are not translated and shown as it is.

Translated: 00:05:51 JST 12/10/2008

Dictionary: Last updated 11/18/2008 / Priority:

**FULL CONTENTS**

**[Claim(s)]**

[Claim 1] In the resistance-welding equipment which inserts a thing to be welded into inter-electrode [ two ], and welds a thing to be welded by pressurization and energization Resistance-welding equipment characterized by having had the motor, and rotation and the straight line conversion mechanism which rotation of this motor was changed into straight line movement of a straight line displacement object, having connected with said straight line displacement object through the oil pressure cylinder by which the electrode which is one side at least was connected with the pressure regulation machine, and being constituted so that two electrodes may be opened and closed relatively.

[Translation done.]

[Claim 2] It is resistance-welding equipment according to claim 1 characterized by for said oil pressure cylinder having a cylinder main part and a piston, forming a pressure room between this cylinder main part and a piston, equipping said pressure regulation machine with an empty pressure cylinder, and exerting the pressure of the empty pressure room of this empty pressure cylinder on the pressure room of said oil pressure cylinder.

[Claim 3] Said straight line displacement object is the ball screw which has a penetration hole in the direction of an axis, and the cylinder main part of said oil pressure cylinder or a piston is fixed to the end of said ball screw. While another side of a cylinder main part and a piston is connected with one [ said ] electrode The connection rod with which the end was connected with one

[ said ] electrode is arranged on the penetration hole of said ball screw. Resistance-welding equipment according to claim 1 or 2 characterized by being constituted so that a spring may be prepared between the other end of said ball screw, and the other end of a connection rod and said oil pressure cylinder may be energized in the compression direction through a connection rod.

[Claim 4] Resistance-welding equipment according to claim 3 characterized by having made the other end of said connection rod project from the other end of said ball screw, and using said spring as a compression spring.

[Claim 5] Resistance-welding equipment according to claim 1, 2, 3, or 4 characterized by connecting one [ said ] electrode with said another side of the cylinder main part of an oil pressure cylinder, and a piston at one, and for the electrode of another side being supported by the fixed side arm, and forming C type Gand.

[Claim 6] It is supported by the end of the 1st arm which one [ said ] electrode can rotate to the circumference of a pivot. Said another side of the cylinder main part of an oil pressure cylinder and a piston is connected with the other end which sandwiched said pivot of the 1st arm. Resistance-welding equipment according to claim 1, 2, 3, or 4 characterized by interlocking with [ arm / said / 1st ] the electrode of another side, being supported by the end of the 2nd arm which can be rotated, and forming X type Gand.

---

#### [Detailed Description of the Invention]

##### [0001]

[Field of the Invention] This invention inserts a thing to be welded into inter-electrode, and relates to the structure of the resistance-welding equipment which controlled vibration of the electrode in the process which sandwiches a thing to be welded especially about the resistance-welding equipment which energizes in the state of pressurization and welds with electrical resistance heat.

##### [0002]

[Description of the Prior Art] Conventionally, with resistance-welding equipment, an air cylinder is used for the drive of an electrode and the electrode connected with the piston rod of the air cylinder moves up and down corresponding to the stroke (or horizontal movement). However, in order to correspond to the form of various things to be welded, a stroke until a long stroke is required and actually sandwiches a thing to be welded from the reference position is fairly large. For example, at the thing for the panel for cars etc., it is made the opening gap of an electrode and there are many about 100mm things. Since the characteristic top piston rod of an air cylinder must return to the above-mentioned reference position again after the pressurization of 1 RBI and welding finish, most time will be required.

[0003] As this measure, there is a thing using an electric servomotor with easy position control. Since this does not need to return each time to the reference position which requires a big opening gap like [ since a thing to be welded and an inter-electrode opening gap can be set up arbitrarily / in the case of being based on an air cylinder ], time shortening is possible only for the part. Thereby, for example in comparison of the equipment of this scale, the improvement to 1-RBI 1.8 seconds is obtained from 1-RBI 2.5 seconds by an air cylinder by the servomotor.

[0004]

[Problem to be solved by the invention] However, in the thing using the above-mentioned servomotor if it is going to shorten working hours further There was a limit in time shortening -- when the working speed of the electrode by a servomotor is raised and done so, an electrode will sandwich a thing to be welded shockingly, an electrode vibrates by the rebounding, for example, the effective pressurization in the following welding point becomes impossible etc.. Therefore, this invention aims at offering the resistance-welding equipment which enables much more weld time shortening, while even \*\* obtains good welding for vibration by rebounding at the time of an electrode sandwiching a thing being welded in view of the above-mentioned conventional problem.

[0005]

[Means for solving problem] For this reason, this invention inserts a thing to be welded into inter-electrode [ two ], and sets it to the resistance-welding equipment which welds a thing to be welded by pressurization and energization. It should have the motor, and rotation and the straight line conversion mechanism which rotation of a motor was changed into straight line movement of a straight line displacement object, and should connect with the above-mentioned straight line displacement object through the oil pressure cylinder by which the electrode which is one side at least was connected with the pressure regulation machine, and it should be constituted so that two electrodes might be opened and closed relatively.

[0006] The above-mentioned oil pressure cylinder has a cylinder main part and a piston, and forms a pressure room between a cylinder main part and a piston, and, as for a pressure regulation machine, it is desirable that shall have an empty pressure cylinder and the pressure of the empty pressure room of an empty pressure cylinder shall be exerted on the pressure room of an oil pressure cylinder.

[0007] Furthermore, the above-mentioned straight line displacement object is the ball screw which has a penetration hole in the direction of an axis. While the cylinder main part of an oil pressure cylinder or a piston is fixed to the end of a ball screw and another side of a cylinder main part and a piston is connected with above-mentioned one electrode The connection rod with which one end was connected with above-mentioned one electrode can be arranged on the penetration hole of a ball screw, and a spring can be prepared between the other end of a ball screw, and the other end of a connection rod, and it can constitute so that an oil pressure cylinder may be energized in the compression direction through a connection rod. It is desirable to make the other end of a connection rod project from the other end of said ball screw, and to use said spring as a compression spring especially.

[0008] In addition, above-mentioned one electrode is connected with another side of the cylinder main part of an oil pressure cylinder, and a piston at one, and it can be considered as C type G and where the electrode of another side was supported by the fixed side arm. Or it is supported by the end of the 1st arm which one electrode can rotate to the circumference of a pivot. Another side of the cylinder main part of an oil pressure cylinder and a piston is connected with the other end which sandwiched the pivot of the 1st arm, and it can be considered as X type G and which the electrode of another side was interlocked with the 1st arm, and was supported by one end of the 2nd arm which can be rotated.

[0009]

[Function] A drive of a motor will change the rotation into straight line movement of a straight line displacement object according to rotation and a straight line conversion mechanism. Suitable welding will be performed by energization, if the pressurization power increases and the electrode connected with the straight line displacement object through the oil pressure cylinder becomes a certain installation value, after contacting a thing to be welded. The shock at the time of an electrode contacting a thing being welded is absorbed by the oil pressure cylinder connected with the pressure regulation machine in the meantime. When a pressure regulation machine is especially equipped with an empty pressure cylinder, the damper effect is acquired, a shock is fully absorbed and vibration does not occur in an electrode etc.

[0010]

[Mode for carrying out the invention] A work example explains the form of operation of this invention below. Drawing 1 - drawing 3 show the 1st work example which applied this invention to C type Gанд. Resistance-welding equipment 1 is equipped with the arm 6 fixed to the base block 3 which consists of Roar Brock 4 and an upper plate 5, and the base block 3. An arm 6 supports the bottom electrode 61 through the electrode holder 60, and the base block 3 is supporting the rotation and the straight line conversion mechanism connected with the top electrode 62 mentioned later. C type Gанд frame is formed with the base block 3 and the arm 6.

[0011] Resistance-welding equipment 1 is supported by the frame which is not illustrated through suspenders 50. That is, suspenders 50 attach the guide rod 54 between the rod supporters 52 and 53 which the substrate 51 allotted up and down, and are prepared possible [ a slide of a slider 55 ] on the guide rod 54. Between a slider 55 and the rod supporters 52 and 53, springs 56 and 57 are formed, respectively. By fixing the base block 3 to this slider 55, along with the guide rod 54 of suspenders 50, the up-and-down motion of resistance-welding equipment 1 is enabled, and it can respond now to the height of a thing to be welded.

[0012] The servomotor 2 is attached to the upper plate 5 of the base block 3. Belt pulley storage space is formed between Roar Brock 4 and the upper plate 5, and the driving side belt pulley 8 of the diameter of a large and the drive side belt pulley 9 of the byway attached to the output axis of a servomotor 2 are arranged in this storage space. The nut holder 11 is further attached to the upper plate 5, and the nut unit 10 which builds in a ball nut by this is held. The cover 12 is attached to the upper end of the nut holder 11. The driving side belt pulley 8 is connected so that it may really rotate in the ball nut of the nut unit 10.

[0013] In the ball nut of the nut unit 10, the ball screw 15 which has the penetration hole 16 covering full length in an axial center has got into gear. The ball screw 15 penetrated the driving side belt pulley 8 to non-contact, and is extended below while it projects upwards from the nut unit 10.

[0014] The rotation prevention unit 13 which prevents rotation of the ball screw 15 is attached to Roar Brock 4 of the base block 3 by the unit holder 14. A straight gash is formed in the direction of an axis at the ball screw 15, and fixed, i.e., while the ball screw 15 goes up and descends, the rotation is prevented from the rotation prevention unit 13 at the circumference of the axial center of a ball screw by a projection or roller of nonrotation projecting and engaging with the above-mentioned straight gash. Rotation and a straight line

conversion mechanism are formed of the above-mentioned nut unit 10, the ball screw 15, and the rotation prevention unit 13, and rotation of a servomotor 2 is changed into straight line movement of the ball screw 15 by connecting the driving side belt pulley 8 and the drive side belt pulley 9 by a belt 7.

[0015] The oil pressure cylinder 20 is fixed to the lower end of the ball screw 15, and the bracket 31 with which the guide rod 30 was attached in parallel with the ball screw 15 is being fixed to piston 22 lower end of the oil pressure cylinder 20. And the guide plate 32 which has the guide hole to which it shows this guide rod 30 is being fixed to the unit holder 14. The connection rod 17 is arranged on the penetration hole 16 of the ball screw 15. The top electrode 62 is attached to the lower end of the connection rod 17 through the electrode holder 63, and the power connector 64 is attached to the electrode holder 63. Furthermore, the connection rod 17 has a screw part at the upper end, projects it from the upper end of the ball screw 15, and is always energized up to the ball screw 15 with the compression spring 33 arranged between the washer 19 positioned with the nut 18, and the upper end of the ball screw 15.

[0016] As the oil pressure cylinder 20 is shown in drawing 2, the cylinder main part 21 has the inner cylinder part 23 which lets the connection rod 17 pass in an axial center by consisting of a cylinder main part 21 and a piston 22, therefore the piston 22 is assuming the shape of a cross-sectional cylinder. It projects in the upper end of the cylinder main part 21, a part 24 is formed, and the lower end of the ball screw 15 is fixed to this projection part 24. On the other hand, by supplying oil pressure to the pressure room 25 via a pipe 27 from the pressure regulation machine 40, the cylindrical piston 22 is energized so that it may project from the cylinder main part 21 to a lower part. A bracket 31 is fixed to the lower end side of this piston 22 with a bolt 26.

[0017] As mentioned above, [ the rod ] so that clearly from drawing 2 since the connection rod 17 is always energized up with the compression spring 33 The major diameter 17B of the lower end made into the diameter of a large from the general section of the connection rod 17 pushes up the bracket 31 fixed to piston 22 lower end of an oil pressure cylinder, and a piston 22, a bracket 31, and the connection rod 17 are displaced to one. Therefore, the piston 22 of the oil pressure cylinder 20 will be connected with one by this again the electrode side containing the top electrode 62 and the electrode holder 63. In addition, since it is connected by the compressive force which minded the connection rod 17 here, suppose that the bolt 26 which fixes a bracket 31 to the lower end side of a piston 22 depending on the case is also unnecessary.

[0018] Especially the pressure regulation machine 40 consists of oil pressure passage parts 43 connected to the pipe 27 to an oil reservoir 41, the empty pressure cylinder 42, and the oil pressure cylinder 20, as shown in drawing 3.

A piston 44 is formed in the empty pressure cylinder 42 possible [ up-and-down motion ], and the rod 45 prolonged from a piston 44 goes up and down the oil pressure passage part 43. When a piston 44 is located near the upper end of the empty pressure cylinder 42, the oil pressure passage part 43 and an oil reservoir 41 are open for free passage with the free passage opening 46, but the air of predetermined pressure is sealed and the up space by the side of the rod 45 divided at the piston 44 of the empty pressure cylinder 42 and opposite forms the empty pressure room 47. Thereby, the piston 44 is descending in the state, and the free passage opening 46 of the oil pressure passage part 43 and an oil reservoir 41 was closed with the rod 45, and has usually done predetermined oil pressure to the oil pressure cylinder 20 through the pipe 27.

[0019] Next, the operation in the above-mentioned composition is explained. If a servomotor 2 drives to one way first and the drive side belt pulley 9 rotates from the opening state of the up-and-down electrodes 62 and 61. The rotation is transmitted to the driving side belt pulley 8 with a belt 7, and is changed into straight line downward displacement of the ball screw 15 by the rotation and the straight line conversion mechanism which consists of the nut unit 10, a ball screw 15, and a rotation prevention unit 13. The rotational torque added to the ball screw 15 in the case of conversion is paid by the rotation prevention unit 13, and the ball screw 15 does not rotate during descent or a next rise. Since the displaced guide rod 30 is guided with the guide plate 32, even if both the ball screws 15 descend greatly, they move toward a straight bottom electrode.

[0020] The top electrode 62 which descended with the ball screw 15 through the oil pressure cylinder 20 collides with the thing on the bottom electrode 61 to be welded, and stops compulsorily. Since the servomotor 2 is still driven here, the ball screw 15 still tends to descend in spite of a stop of the top electrode 62. For this reason, the oil pressure cylinder 20 is sagged and that piston 22 is energized in the compression direction. This compression is transmitted to the pressure regulation machine 40 through a pipe 27, raises the piston 44 of the empty pressure cylinder 42, and heightens the pressure of the empty pressure room 47. As a result, the oil pressure of the pressure room 25 of the oil pressure cylinder 20 increases, and this serves as pressurization power over a thing to be welded.

[0021] Since the torque of a servomotor 2 will increase if pressurization power increases, when it becomes the torque which detects this torque, for example, is equivalent to predetermined pressurization power, such as 200 etc.kg, the drive of a servomotor 2 is stopped. Energization is performed among the up-and-down electrodes 62 and 61 via the power connector 64 after this servomotor stop. And if energization of predetermined time is completed, a servomotor 2 will drive to an opposite direction. In this way, the top electrode 62 goes up to a predetermined opening position smoothly, without producing vibration, and welding of 1 RBI is completed.

[0022] While driving the top electrode 62 with a servomotor 2 using the rotation and the straight line conversion mechanism which this example is constituted as mentioned above and contains the ball screw 15. Since the oil pressure cylinder 20 connected to the pressure regulation machine 40 shall be formed between the ball screw 15 and the top electrode 62, a servomotor 2 shall be driven even after the top electrode's 62 contacting a thing to be welded, and predetermined pressurization power shall be acquired. The opening gap of electrodes 61 and 62 can be made small, moreover, a servomotor 2 can be driven at a stretch to energization timing, and weld time is shortened notably -- 1-RBI 1.2 seconds are realized on the thing and this scale level which were shown in the Prior art.

[0023] Moreover, the shock at the time of an electrode contacting a thing being welded is absorbed by the oil pressure cylinder 20 connected with the pressure regulation machine 40. By having the empty pressure cylinder 42, the damper effect is acquired, a shock is fully absorbed and vibration does not generate the pressure regulation machine 40 in particular in an electrode etc. after that.

[0024] Drawing 4 shows the 2nd work example of invention. This is taken as the resistance-welding equipment of X type G and instead of C type. With the resistance-welding equipment 100 of this example, the bottom base arm 73 and the top base arm 77 are supported respectively possible [ rotation ] at the

circumference of two pivots 71 and 72 which set the predetermined interval on the base frame 70, and were prepared in it. The bottom base arm 73 is equipped with the long arm 75 prolonged to a counter direction on both sides of a pivot 71, and the short arm 76. The top base arm 77 is similarly equipped with the long arm 78, and the short arm 76 and the short arm 79 of a symmetric figure. The electrode support arms 81 and 82 are fixed to the short arms 76 and 79 of the bottom and the top base arms 73 and 77 with a bolt 83 through the attachment bracket 80 of the body non-conducting current, respectively, and both the base arms 73 and 77 and the electrode support arms 81 and 82 are intercepted electrically.

[0025] The end has turned at the electrode support arms 81 and 82 in the direction approached mutually, and they are supported through the electrode holder 84 at each tip so that the bottom electrode 85 and the top electrode 86 may counter mutually. The top base arm 77 and the bottom base arm 73 consist of states where the bottom and the top electrodes 85 and 86 contact mutually so that it may become abbreviation parallel mutually. In the bottom base arm 73 and the top base arm 77, the engagement arms 87 and 88 prolonged to an inner direction were formed so that it might rotate to each and one, and on them, it has geared with the teeth 89 and 90 formed at each tip. Thereby, the top base arm 77 and the bottom base arm 73 interlock, and are rotated symmetrically.

[0026] Base block 3' which formed belt pulley storage space on Roar Brock 4' and the upper plate 5 is supporting rotation and the straight line conversion mechanism of the same composition as a last work example. The ball screw 15 of rotation and a straight line conversion mechanism is prolonged so that an abbreviation rectangular cross may be carried out like illustration with the bottom base arm 73 at the time of the state where the bottom and the top electrodes 85 and 86 contact mutually, and the oil pressure cylinder 20 is formed between the ball screw 15 and the tip of the arm 75 with a long bottom base arm. Moreover, the tip of the arm 78 with a long top base arm is divided into two forks as shown in drawing 5, and it is connected with the unit holder 14 of the rotation prevention unit 13 possible [ rotation ] by the pin 91.

[0027] As the oil pressure cylinder 20 was explained in full detail in the last work example, it consists of a cylinder main part 21 and a piston 22, and projects in the upper end of the cylinder main part 21, a part 24 is formed, and the lower end of the ball screw 15 is fixed to this projection part. On the other hand, by supplying oil pressure to the pressure room via a pipe 27 from the pressure regulation machine 40, a piston 22 is energized so that it may project from the cylinder main part 21 to a lower part.

[0028] Connection rod 17' is allotted to the penetration hole of the ball screw 15, and the lower end is connected with the tip of the long arm 75 of the bottom base arm 73 possible [ rotation ] through connection part 17'C. Connection rod 17' has a screw part at the upper end, projects it from the upper end of the ball screw 15, and is always energized up to the ball screw 15 with the compression spring 33 arranged between the washer 19 positioned with the nut 18, and the upper end of the ball screw 15. These ball screw 15, the oil pressure cylinder 20, and the lower end (connection part 17'C) of other composition of connection rod 17' in the assembly of connection rod 17' are the same as that of a last work example except for the point connected with the tip of the arm 75 with a long bottom base arm.

[0029] Thereby, the ball screw 15 goes up or descends by the drive of a

servomotor 2, and the bottom base arm 73 rotates to the circumference of a pivot 71. Rotation of the bottom base arm 73 is transmitted to the top base arm 77 by the engagement arms 87 and 88. The top electrode 86 and the bottom electrode 85 which were supported by the top base arm 77 and the bottom base arm 73 approach mutually, are closed, or are opened in the direction estranged mutually and build a predetermined opening gap.

[0030] Since this example is constituted as mentioned above, while weld time is shortened notably, the shock at the time of an electrode contacting a thing being welded is absorbed, and the effect that vibration does not occur in an electrode etc. as well as a last work example is acquired. Moreover, since it is extended and connected so that the ball screw 15 may carry out an abbreviation rectangular cross with the bottom base arm 73 at the time of the state where the bottom and the top electrodes 85 and 86 contact mutually, pressurization power can be most efficiently generated at the time of pressurization and energization.

[0031] In addition, although the cylinder main part 21 of the oil pressure cylinder 20 is fixed to the ball screw 15 and the piston 22 is connected the electrode side in each above-mentioned work example, it is not limited to this, but a piston is conversely fixed to a ball screw, and you may make it connect a cylinder main part the electrode side. Furthermore, although the oil pressure cylinder 20 was formed in the top electrode 62 side which carries out rise descent in the 1st work example, you may make it support the bottom electrode 61 of the arm of a fixed side in an oil pressure cylinder.

[0032] Moreover, although the oil pressure cylinder connected to the pressure regulation machine was used in the work example, it can change to this and a shock absorber etc. can also be used. And it is not limited to what also depends rotation and a straight line conversion mechanism on a ball screw and a nut, but if rotation of a motor is changed into straight line movement, regardless of the form, it is employable. Moreover, it mates with the plane part which formed the plane part prolonged in the direction of an axis in the ball screw besides the combination of a projection or a roller which engages with this with a straight gash, and formed this plane part in the rotation prevention unit of a fixed side also about rotation prevention of the ball screw, and may be made to carry out an up-and-down slide.

[0033] [Effect of the Invention] This invention is equipped with rotation and the straight line conversion mechanism in which rotation of a motor is changed into straight line movement of a straight line displacement object, in resistance-welding equipment as above. Since it constituted so that the electrode which is one side at least might be connected with said straight line displacement object through the oil pressure cylinder connected with the pressure regulation machine and two electrodes might be opened and closed relatively The opening gap of an electrode can be set up small, and also after contacting a thing to be welded, the shock at the time of suitable welding being performed by predetermined pressurization power, and an electrode contacting a thing being welded by the pressure regulation according to an oil pressure cylinder in \*\* in that case is absorbed by continuing motorised. When the pressure regulation machine especially connected to an oil pressure cylinder is equipped with an empty pressure cylinder, the damper effect is acquired and much more impact-absorbing performance is demonstrated.

[Brief Description of the Drawings]

[Drawing 1] It is the figure showing the 1st work example of this invention.

[Drawing 2] It is the enlarged drawing showing the details for an oil pressure cylinder part.

[Drawing 3] It is the figure showing a pressure regulation machine.

[Drawing 4] It is the figure showing the 2nd work example.

[Drawing 5] \*\*\*\* A in drawing 4 is shown -- it is a fracture enlarged drawing in part.

[Explanations of letters or numerals]

1, 100 Resistance-welding equipment

2 Servomotor

3, 3 Base block

4, 4 Roar Brock

5 Upper Plate

6 Arm

8 Driving Side Belt Pulley

9 The Drive Side Belt Pulley

10 Nut Unit

11 Nut Holder

12 Cover

13 Rotation Prevention Unit

14 Unit Holder

15 Ball Screw

16 Penetration Hole

17, 17 Connection rod

17B Major diameter

17'C Connection part

20 Oil Pressure Cylinder

21 Cylinder Main Part

22 Piston

23 Inner Cylinder Part

24 Projection Part

25 Pressure Room

27 Pipe

30 Guide Rod

31 Bracket

32 Guide Plate

33 Compression Spring

40 Pressure Regulation Machine

41 Oil Reservoir

42 Empty Pressure Cylinder

43 Oil Pressure Passage Part

44 Piston

45 Rod

46 Free Passage Opening

47 Empty Pressure Room

50 Suspenders

51 Substrate

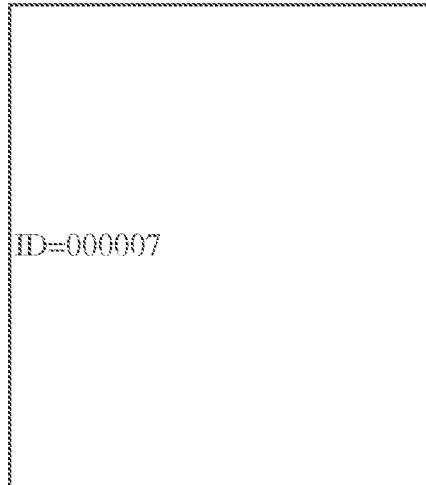
52, 53 Rod supporter

54 Guide Rod

55 Slider  
56, 57 Spring  
60 Electrode Holder  
61 Bottom Electrode  
62 Top Electrode  
63 Electrode Holder  
62 Top Electrode  
64 Power Connector  
70 Base Frame  
71, 72 Pivot  
73 Bottom Base Arm  
75, 78 Long arm  
76, 79 Short arm  
77 Top Base Arm  
80 Attachment Bracket  
81, 82 Electrode support arm  
84 Electrode Holder  
85 Bottom Electrode  
86 Top Electrode  
87, 88 Engagement arm  
89, 90 Tooth  
91 Pin

---

[Drawing 5]



[Drawing 1]

ID=000003

[Drawing 2]

ID=000004

[Drawing 3]

ID:=000005

[Drawing 4]

ID:=000006

[Translation done.]

[Report Mistranslation](#)

[Japanese \(whole document in PDF\)](#)